Surface Processes on Mars and its Satellites

FINAL REPORT

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The objectives of this research were to gain further understanding of the major geological processes on Mars and its satellites through theoretical analysis and observations of volcanism, volcanic deposits and edifices on Mars, and the processes of low-velocity cratering and devolatilization on the satellites.

The accomplishments included the following (1) General theoretical analysis of volcanism in the martian environment to address specific problems associated with plinian, strombolian, hawaiian, vulcanian, and effusive eruptions, specifically the role of volatiles in producing landforms and deposits; examination of aspects of effusive eruptions to assess the origin of pyroclastic cones and sinuous rilles; (2) Assessment of the nature and evolution of martian central volcanic edifices, including comparative morphology and structure, associated volcanological processes, processes of caldera formation and evolution, comparisons in style in space, and time, and aspects of composition; and (3) Theoretical studies of internal and external processes on Phobos and Deimos with emphasis on the processes of low-velocity impact cratering and devolatilization, and comparison to observations.

These accomplishments are documented in the attached list of publications.

Erard, S., Bibring, J. P., Langevin, Y., Forni, O., Rosenqvist, J., Sotin, C., Hurtrez, S., Mustard, J. M., Pieters, C. M., and Head, J. W. (1991) Spatial variations in composition of the Valles Marineris and Isidis Planitia Regions derived from ISM data, *Proceedings from the Lunar and Planetary Science Conference XXI, 21*, 437-455.

Wilson, L., Head, J. W., and Parfitt, E. A. (1991) Factors controlling the ascent of magmas in planetary crusts/lithospheres, *"Magma Paths" symposium on the Internation Union of Geodesy and Geophysics, XX General Assembly, Vienna, Austria, 11-24 August.*

Parfitt, E. A., Wilson, L., and Head, J. W. (1991) Stress distribution in magma chambers, chamber sizes, and eruption styles, *"Advances in Modelling Magma Chambers" Symposium on the International Union of Geodesy and Geophysics, XX General Assembly, Vienna, Austria, 11-24 August.*

Head, J. W. (1991) Geological structures and processes on the terrestrial planets, *Jeffreys Symposium on Interrelation between Geophysical Structures and Processes of the International Union of Geodesy and Geophysics, XX General Assembly, Vienna, Austria, 11-24 August, Program and Abstract*, p. 13.

Crumpler, L. S., Aubele, J. C., and Head, J. W. (1991) Calderas on Mars: Models of formation for the Arsia-Type, *Lunar and Planetary Science Conference XXII*, 269-270.

Murchie, S.L. and Izenberg, N.R. (1991) Integrated geologic map of the equatorial region of Mars, *Lunar and Planetary Science Conference XXII*, 941-942.

Mustard, J. F., Erard, S., Bibring, J-P, Langevin, Y., Head, J. W., and Pieters, C. M. (1991) Composition of Syrtis Major volcanic plateau, *Lunar and Planetary Science Conference XXII*, 951-952.

Wilson, L., Head, J. W., and Parfitt, E. A. (1990) Factors controlling the morphology of volcanic deposits and the structure of volcanic edifices in basaltic volcanoes on Earth, Mars and Venus, *Vernadsky-Brown Microsymposium 12, Moscow.*

Murchie, S. L., Head, J. W., and Efford, N. D. (1989) Morphologic classes of grooves on Phobos, *Lunar and Planetary Science XX*, 744-745.

Mustard, J. F., Bibring, J. P., Erard, S., Fischer, E., Head, J., Hurtrez, S., Langevin, Y., Pieters, C., and Sotin, C. (1990) Interpretations of spectral units of Isidis-Sytris Major from ISM-Phobos, *Lunar and Planetary Science XXI*, 835-836.

Wilson, L., and Head, J. W. (1991) Dynamics of groove formation on Phobos by ejecta from Stickney, *Journal of Geophysics Research*, (submitted).